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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/728,804	12/08/2003	Kia Silverbrook	MTB01US	8902
24011	7590	11/28/2006	EXAMINER	
SILVERBROOK RESEARCH PTY LTD 393 DARLING STREET BALMAIN, NSW 2041 AUSTRALIA			LEBRON, JANNELLE M	
			ART UNIT	PAPER NUMBER
			2861	

DATE MAILED: 11/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/728,804

Applicant(s)

SILVERBROOK, KIA

Examiner

Jannelle M. Lebron

Art Unit

2861

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 13 November 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-11, 13-30, 32-47 and 49-54 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-11, 13-30, 32-47 and 49-54 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 11/13/2006.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-7, 9, 11, 18, 19-26, 28, 30, 37, 38-43, 45, 47, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby (US Patent 5,706,041) in view of Shirota et al. (US Patent 6,076,919) and Campbell et al. (US Patent 4,870,433).

3. Regarding claims 1 and 19, Kubby discloses an ink jet printhead comprising:

a plurality of nozzles, each defining an ejection aperture [column 1, lines 9-10]

and,

at least one heater element corresponding to each of the nozzles respectively, the heater element configured for thermal contact with a bubble forming liquid [column 1, lines 17-23], such that,

heating the heater element to a temperature above the boiling point of the bubble forming liquid [column 5, lines 13-18] forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element, the gas bubble then collapsing to a point of collapse [column 4, lines 59-66];

Thus Kubby teaches the claimed limitations except “the heater element is less than 50 microns from the ejection aperture” and “wherein the point of collapse of the gas bubble is spaced from any solid surface within the inkjet printhead.”

Shirota et al. discloses a recording device where the distance between the heater (2 in fig. 8A) and the ejection outlet (5 in fig.8A) may preferably be 5-80 microns (column 4, lines 43-49). It would have been obvious to one of ordinary skill in the art at the time of applicant's invention to provide a heater element positioned less than 50 microns from its corresponding nozzle. One would have been motivated to so modify Kubby to optimize the heater element as taught by Shirota et al.

Furthermore, Campbell et al. teaches a heater element that, when energized, has a bubble formed at a plurality of portions; the bubble is collapsible and the point of collapse of the gas bubble is spaced from any solid surface (col. 3, lines 60-64). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the heater element design of Campbell et al. One would have been motivated to modify Kubby to prevent cavitation damage to the heater elements as taught by Campbell et al.

4. Regarding claims 2-4 and 20-22, Kubby teaches the claimed limitations as set forth above except the claimed: “the heater element is positioned less than 25 microns from the ejection aperture (claims 2 and 20)”, “the heater element is positioned less than 10 microns from the ejection aperture (claims 3 and 21)”, and “the heater element is less than 5 microns from the ejection aperture (claims 4 and 22).”

It would have been obvious to one of ordinary skill in the art at the time the invention was made to position the heater element less than 25, 10, and 5 microns from the ejection aperture for the purpose of utilizing an optimum range. The applicant should note that it has been held that where the general working conditions of a claim of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

5. The steps of the method claims 38-41 are deemed to be inherent in view of the functions of the apparatus disclosed above, since it would be necessary to perform the claimed method steps in order for the apparatus to perform its intended functions.

6. Regarding claim 5 and 24, Kubby discloses a printhead wherein "the bubble forming liquid and the ejectable liquid are of a common body of liquid (as seen in Figure 5)."

7. Regarding claims 9 and 28, Kubby discloses a printhead "configured to receive a supply of the ejectable liquid at an ambient temperature, wherein each heater element is configured such that the energy required to be applied thereto to heat said part to cause the ejection of a said drop is less than the energy required to heat a volume of said ejectable liquid equal to the volume of the said drop, from a temperature equal to said ambient temperature to said boiling point (column 5, lines 12-26)."

8. Regarding claims 11 and 30, Kubby discloses a printhead "wherein each heater element has two opposite sides and is configured such that a said gas bubble formed

by that heater element is formed at both of said sides of that heater element (column 4, lines 59-63)."

9. Regarding claims 18 and 37, Kubby discloses a printhead "wherein each heater element is substantially covered by a conformal protective coating, the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless (column 4, lines 11-17)."

10. The method claims 42, 45, 47 and 54 are deemed to be inherent in view of the functions of the apparatus disclosed above, since it would be necessary to perform the claimed method step in order for the apparatus to perform its intended function.

11. Regarding claims 6, 7, 25, and 26, Kubby discloses a printhead "being configured to print on a page and to be a page-width printhead (column 1, lines 45-49)" and wherein "each heater element is in the form of a cantilever beam (column 4, lines 47-50)."

12. Regarding claim 23, Kubby discloses a system "being configured to support the bubble forming liquid in thermal contact with each heater element, and to support the ejectable liquid adjacent each nozzle (column 3, lines 10-13)."

13. Regarding the claim 43, Kubby discloses a method "wherein the bubble forming liquid is fed to the at least one heater element so that it substantially surrounds the heater element (column 4, lines 59-63)."

14. Claims 8, 27 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby (US Patent 5,706,041) in view of Shirota et al. (US Patent 6,076,919) and Campbell et al. (US Patent 4,870,433) as applied to claim 1 above, and further in view of Silverbrook (US Patent 5,841,452).

Kubby in view of Shirota et al. and Campbell et al. teach the claimed limitation except "wherein each heater element is configured such that an actuation energy of less than 500 nanojoules (nJ) is required to be applied to that heater element to heat that heater element sufficiently to form a said bubble in the bubble forming liquid thereby to cause the ejection of a said drop."

Silverbrook teaches a thermal inkjet printer where "the heater energy is typically 200nJ per drop [column 18, lines 15-18]." It would have been obvious to one of ordinary skill in the art at the time of applicant's invention to provide a heater configured to have an actuation energy of 200nJ. One would have been motivated to so modify Kubby in view of Shirota et al. and Campbell et al. to reduce the power dissipation without affecting print speed as taught by Silverbrook.

15. The method claim 44 is deemed to be inherent in view of the functions of the apparatus disclosed above, since it would be necessary to perform the claimed method step in order for the apparatus to perform its intended function.

16. Claims 10, 29 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby (US Patent 5,706,041) in view of Shirota et al. (US Patent 6,076,919) and

Campbell et al. (US Patent 4,870,433) as applied to claim 1 above, and further in view of Feinn (US Patent 6,543,879).

Kubby in view of Shirota et al. and Campbell et al. teach the claimed limitation except "comprising a substrate having a substrate surface, wherein the area density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square cm of substrate surface."

Feinn teaches an inkjet printhead where "the area of the ink slot is at least approximately 100 nozzles per square millimeter ( $\text{mm}^2$ ) (Abstract – Column 1, lines 64-67)." It would have been obvious to one of ordinary skill in the art at the time of applicant's invention to provide a printhead with a nozzle density of at least 10,000 nozzles per  $\text{cm}^2$ . One would have been motivated to so modify Kubby in view of Shirota et al. and Campbell et al. to improve the resolution of the printhead as taught by Feinn.

17. The method claim 46 is deemed to be inherent in view of the functions of the apparatus disclosed above, since it would be necessary to perform the claimed method step in order for the apparatus to perform its intended function.

18. Claims 13, 14, 32, 33, 49 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby (US Patent 5,706,041) in view of Shirota et al. (US Patent 6,076,919) and Campbell et al. (US Patent 4,870,433) as applied to claim 1 above, and further in view of Silverbrook (US Patent 6,019,457).



Kubby in view of Shirota et al. and Campbell et al. teach the claimed limitation except "comprising a structure that is formed by chemical vapor deposition (CVD), the nozzles being incorporated on the structure."

Silverbrook teaches a structure (142) that is formed by CVD [column 8, lines 66-67], whose thickness "can be about 4 microns [column 9, lines 8-9], and has nozzles incorporated to it [column 9, lines 9-10]." It would have been obvious to one of ordinary skill in the art at the time of applicant's invention to provide a structure that is formed by CVD, wherein the structure is 10 microns thick and has nozzles incorporated to it. One would have been motivated to so modify Kubby in view of Shirota et al. and Campbell et al. to provide mechanical strength to resist the shock of exploding vapor bubbles and protection against external environment as taught by Silverbrook.

19. The method claims 49 and 50 are deemed to be inherent in view of the functions of the apparatus disclosed above, since it would be necessary to perform the claimed method steps in order for the apparatus to perform its intended functions.

20. Claims 15, 34 and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby (US Patent 5,706,041) in view of Shirota et al. (US Patent 6,076,919) Campbell et al. (US Patent 4,870,433) as applied to claim 1 above, and further in view of Komuro (US Patent 4,965,594).

Kubby in view of Shirota et al. and Campbell et al. teach the claimed limitation except "the heater elements within each chamber being formed on different respective layers to one another."

Komuro teaches an inkjet printhead having a heater that is formed in a plurality on different layers (column 3, lines 35-65, Figure 1 and 2). It would have been obvious to one of ordinary skill in the art at the time of applicant's invention to provide a heater formed on different layers. One would have been motivated to so modify Kubby in view of Shirota et al. and Campbell et al. to produce a graded recording as taught by Komuro.

21. The method claims 51 is deemed to be inherent in view of the functions of the apparatus disclosed above, since it would be necessary to perform the claimed method steps in order for the apparatus to perform its intended functions.

22. Claims 16, 35 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby (US Patent 5,706,041) in view of Shirota et al. (US Patent 6,076,919) and Campbell et al. (US Patent 4,870,433) as applied to claim 1 above, and further in view of The Fabrication and Reliability Testing of Ti/TiN Heaters (DeMoor).

Kubby in view of Shirota et al. and Campbell et al. teach the claimed limitation except "wherein each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50."

DeMoor teaches that is desirable to use a heater made of Ti/TiN in integrated MEMS systems (a thermal inkjet is such a system), because this material provides the advantages of CMOS fabrication (low cost and uniformity) in combination with a very high reliability (see conclusion). Ti has an atomic number of 22. It would have been

obvious to one of ordinary skill in the inkjet art at the time the invention was made to have provided Kubby in view of Shirota et al. and Campbell et al. with a Ti/TiN heater. One would have been motivated to so modify Kubby in view of Shirota et al. and Campbell et al. to provide the advantages of CMOS fabrication (low cost and uniformity) in combination with a very high reliability, as taught by DeMoor.

23. The method claims 52 is deemed to be inherent in view of the functions of the apparatus disclosed above, since it would be necessary to perform the claimed method steps in order for the apparatus to perform its intended functions.

24. Claims 17, 36 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby (US Patent 5,706,041) in view of Shirota et al. (US Patent 6,076,919) and Campbell et al. (US Patent 4,870,433) as applied to claim 1 above, and further in view of Yamashita (US Patent 5,969,005).

Kubby in view of Shirota et al. and Campbell et al. teach the claimed limitation except "wherein each heater element includes solid material and is configured for a mass of less than 10 nanograms of the solid material of that heater element to be heated to a temperature above said boiling point thereby to heat said part of the bubble forming liquid to a temperature above said boiling point to cause the ejection of a said drop."

Yamashita teaches that the ink is jetted at an output of from 1 to 70 nanograms per droplet to effect recording (abstract, column 30, lines 29-32, lines 38-40, column 31, lines 18-22). It would have been obvious at the time the invention was made to a

person having ordinary skill in the ink jet art to modify Kubby in view of Shirota et al. and Campbell et al. with the output of 1 to 70 nanograms per droplet to effect recording. One would have been motivated to so modify Kubby in view of Shirota et al. and Campbell et al. to provide a greater surface area of the droplet, thus strongly improving image quality as taught by Yamashita.

25. The method claims 53 is deemed to be inherent in view of the functions of the apparatus disclosed above, since it would be necessary to perform the claimed method steps in order for the apparatus to perform its intended functions.

***Communication with the USPTO***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jannelle M. Lebron whose telephone number is (571) 272-2729. The examiner can normally be reached on Monday thru Friday 8:30am-5:00pm.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen D. Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2861

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



**Jannelle M. Lebrón**  
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**11/24/2006**



11/27/06  
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